Reduction of stacker tilting shaft and rollers breakdown

[1]M.Balaji , [2]Veerabhadrappa Algur, [3]Shivakumar.B
[1]Assistant professor, [2]Assistant professor, [3]PG student
[1] Department of Mechanical engineering,
[1]Rao Bahadur Y. Mahabaleswarappa Engineering College, Ballari, Karnataka state, India

Abstract—In this work where stacker is machinery equipment in Cut to length unit where the stacker tilting shaft and roller are bended and sometimes sheared if excess load is acted on it due to this the production of CTL unit goes down and quality of sheet is reduced and more scrap will be obtained and unsafe environment because the sheets will get bended in stacker in between rollers while operating because of tilting design problem so the bent sheet has sharp corner's must be handled carefully handled. So after the Modification of stacker tilting rollers and tilting shaft design it reduces the delay time in stacker by 2hours for every tilting shaft change and there by achieving higher production rates. And Necessity of taking out the bended sheets are reduced due to less number sheets bend after modification and total operation time of machine is improved and safe work environment.

Keywords— CTL, Stacker, tilting shaft and rollers

I. INTRODUCTION

HSM2 is one of the major departments of JSW where the conversion of raw materials like slabs into HR Coils. And in CTL HR coil is converted in to HR plates.

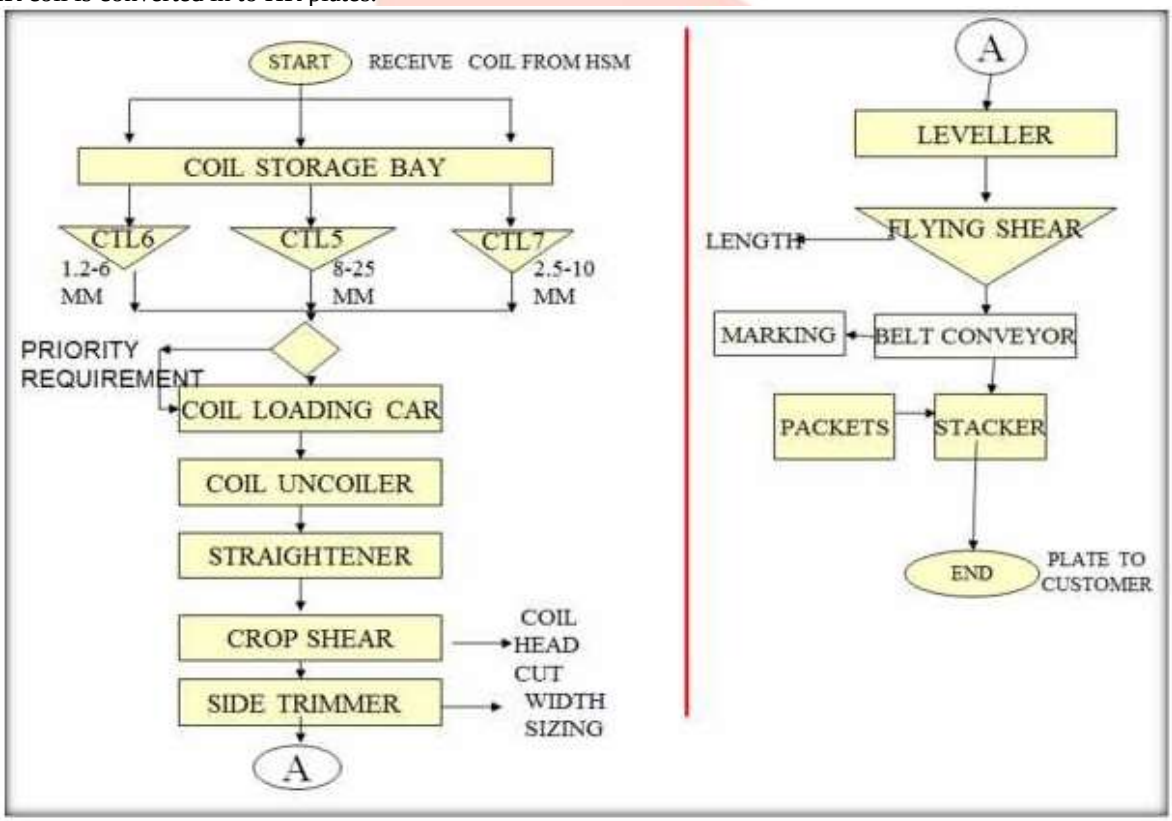


Figure1:CTL OVERVIEW

In HSM#2 the slabs are get converted into coils the coils initially are in higher temperature and stored in coil yards. The cut to length in used for converting rolled products into flat products the coils produced from HSM#2 are further cooled and processed in CTL to form the coils in plates or sheets of required length which are further used for construction and other uses.
The coils are cooled and loaded in uncoiler mandrel for uncoiling the coil and pinched in pinch roll and passed through the straightener for making rough flat sheets for initially loading the coil and after it passed through inspection table for checking any defects and scratches or any dent marks to check and after it passed through Leveller where the Leveller has 11 rolls top 5roll and bottom 6 rolls and followed by backup rolls for making the strip into fully flat sheets and then 2nd pinch roll is used for the sheet to get sheared into required length which is recorded by encoder and passed to flying shear to get required

length in which blades are used for shearing the strip and passed through belt conveyors and stacked in bomb door stacker through tilting roller and shaft mechanism and packets or bundles are made according to weight required by customers after that passed through weighing table and passed through the exit chain conveyors and packed the packets and dispatched

Main equipment's in ctl

1. Leveller

Leveller is one of the important unit in CTL for making flat sheets through screw down mechanism where in leveller different width of plate are processed here 2000mm width strip is making flat through 3mm tilting of 8mm or 12mm thickness coils and 1500 width coils are turned into flat through 2mm tilting of 8 to 20mm thickness and above 20mm thickness plate it is turned flat through 1mm tilting.

Leveller consists of 11 work rolls in which 5are top work rolls and 6 are bottom work are rolls and contains backup roll which are in contact with the work roll which give load and support to work rolls for making the strip flat.

2. Flying Shear

For each cycle and starting from rest position, these shears accelerate until their speed is synchronized with that of the strip, and cut the strip while the speeds are synchronized (and the relative speed is therefore zero). They then withdraw to rest position for the cycle to begin again.

3. Stacker

This is a non-stop stacking machine. When the Stacker detects presence of sheet it is commanded to open. The sheet falls and builds up the package.

The fall distance is always the same. Stacker level cell makes the tables move down every time a sheet falls.

Stacker can work in two independent stacking areas: Lifting table 1+2 (Length=6500+6500mm)

II.LITERATURE REVIEW

Cut to length line is a very special line and CTL in JSW steel has three units CTL#5, 6&7. In CTL there are many equipment's like uncoiler, straightener, Leveller, flying shear, and bomb door stacker.Checked all the lines and understand the operating procedures and their use and started noted down the major problems in CTL and listed all the problems in which the stacker has the major problem which was affecting the production and time by using Pareto chart.

TABLE 1 PROBLEMS IN C

SL NO	AREA WISE CAUSES	OCCURANCE	TOTAL TIME DELAY IN MIN	CUMILATIVE TOTAL	% TOTAL	CUMILATIVE %
1	STACKER TILTING SHAFT SHEAR OR BEND	28	2845	2845	37.8	37.8
2	STACKER TILTING ROLL BEND	13	665	3510	17.6	55.4
8	FLYING SHEAR BLEDE MARK	8	660	4170	10.8	66.2
5	STACKER STOPER BUMPER NOT WORKING	7	745	4915	9.5	75.7
7	LEVELLER WORK ROLL JAM	6	665	5580	8.1	83.8
9	FLYING SHEAR WHEEL CLUTCH AND BREAK	4	345	5925	5.4	89.2
4	STACKER TILTING CONNECTING ROD DAMAGED	2	150	6075	2.7	91.9
6	UNCOILER EXPAND COLLAPLE KEY SHEAR	2	150	6225	2.7	94.6
10	EXIT CHAIN CONVEYOR CHAIN LINK CUT	2	50	6275	2.7	97.3
3	STACKER TILTI NG ROLL BEARING DAMAGED	1	30	6305	1.4	98.6
11	EXIT ROLLER TABLE DRIVE CHAIN DAMAGED OR CUT	1	30	6335	1.4	100.0
TOTAL BREAK DOWN OCCURANCES		74	6335		100	

Pareto analysis

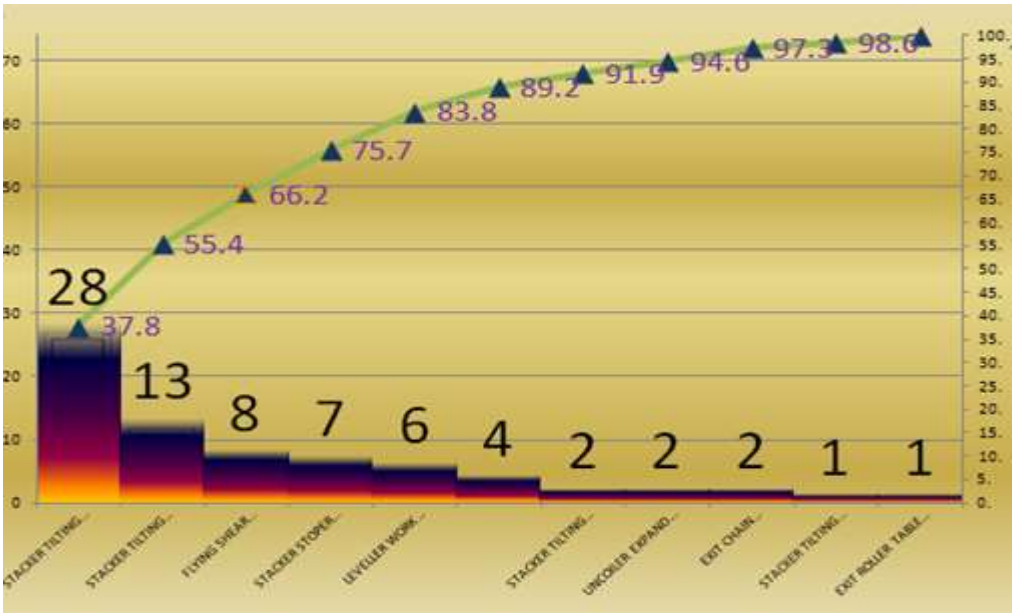


Figure 2: PARETO ANALYSIS

The stacker function is to make the plates of single pieces into bundles and send them for weighing and in stacker in order to make bundle the stacker tilting rollers has to be opened with the help of tilting shaft and tilted and plate has to be fallen on table on doing tilting mechanism the tilting roller were getting bend and tilting shafts has been sheared.

This was the huge problem in CTL and around 2 hours is required for changing the tilting shaft and 1 hour for replacing the tilting roller this has taking away the productivity and time consumption is more.

So started working on to reduce this delay and breakdown to improve the production capacity of the CTL. When the sheets drifted on belt conveyor or when sheets come's bend to the stacker the tilting rollers when tilting gets bend at the edge of plate as well as roller and when excess load is acted the shafts gets sheared so in order to avoid the In-charge of CTL of maintenance department tried to adjust the adjust the tilting arm over the length of 565mm and maintained that but also due to vibrations the same problem was occurred.

The same CTL line has other different mechanisms and techniques of stacker in some the stacker there is no tilting mechanism just the sheet at belt conveyor runs at high speed and falls on lifting table and back pusher pushes the sheet and make proper stacking that is in kohler machinenabu there is no stacker tilting mechanism just the sheet falls on the table the line in-charge over earlier has decided to change the stacker equipment with stacking section but due to time and budget control it was decided to drop off.

The CTL line in JSW has shears only square and rectangle sheets but in other countries like japan and china they can shear trapezoidal shape also they can shear short of length of 200mm also but in JSW the minimum length of 1000mm can be cut.

The customer requirement is have good quality of sheets and require delivery in right time so department required to make the alteration to mechanism and other related unique thinking of production in-charge to reduce break down of shaft and tilting rollers bend so I decided to take down the project of increasing the production capacity by reducing break down so I was under working Mr. Kandoji the in-charge so based on TQM technique's and Tools started working to avoid break down of stacker tilting shafts.

III.PROBLEM IDENTIFICATION

1.Case: Stacker is the important equipment in CTL area where sheets after sheared in flying shear are transferred belt conveyor and then passed to stacker to stacking of sheets by use of tilting shaft mechanism and tilting rollers. If the sheets comes cross in the belt conveyor due to belt drifting and if sheets are not given proper load in Leveller it gets bow and while falling in stacker the sheets get struck in the tilting roller and tilting roller gets bend in case of higher thickness the tilting roller as well as tilting shaft both gets bend and sometimes the tilting shaft gets sheared so the sheet gets rejected and made commercial because customer not accepts the damaged material and too much delay in replacing tilting shaft and tilting rollers and involves harmful activities in removing out the bended sheets out of the rollers because the sheets have sharp corners and makes and this problems creates more delay and reduces the production rate and the machine availability.

IMPACT OF ABOVE CASES:

Delay in production.
Generates marks, which affects quality of sheets /plates produced.
Plate damage in turns generates Scrap.
Spares High Inventory is to be maintained.
Less plates transferring to the stacker, which directly affects our productivity.
Finally, Equipment availability lags.

IV OBJECTIVES

1. increasing the production rate.
2. Reduction in operation time delay.
3. Reduction of maintenance time and breakdown.
4. Improvement in quality & quantity of sheet production.
5. Reduction in sheet damages and scrap generation.
6. Increasing Machine availability.
7. Reduction in spare inventory.

V METHODOLOGY

1. Initially the major problem in CTL found that stacker has major delay and list out the problems of stacker.
2. Found that stacker tilting roller and shaft bending so used TQM tools to find root causes for the problem.
3. Checked the man, machine, method and material related problems to know the root causes
4. And found that design of the machine was fault there for it has to modify to make way for proper working.
5. Corrected the dimensions of the shaft and belt drifting and changed the cam design and tilting roll and shaft has been modified.
6. Assembly to the stacker of new designed shaft and cam and trials taken to working and found that working was proper and shaft and tilting roller are reduced from breakdown.
7. Kept on checking the performance of stacker and performance was excellent

VI EXPERIMENTAL SETUP

Experimental setup consists of tilting shaft and roller and cam and Plummer block and sensors

First the tilting roller are fixed to stacker side guide assembly of new modified rollers. All the roller are driven by one motor and connected the all the rollers with chain.

The tilting shafts are coupled to the gearbox and motor for operation of tilting shaft and shafts are fixed with Plummer block.

And sensors are fixed tilting shaft tie rod for feedback of tilting shaft whether it is open or closed. Now stacker can be operated for open and close of the tilting shaft for stacking the sheets.

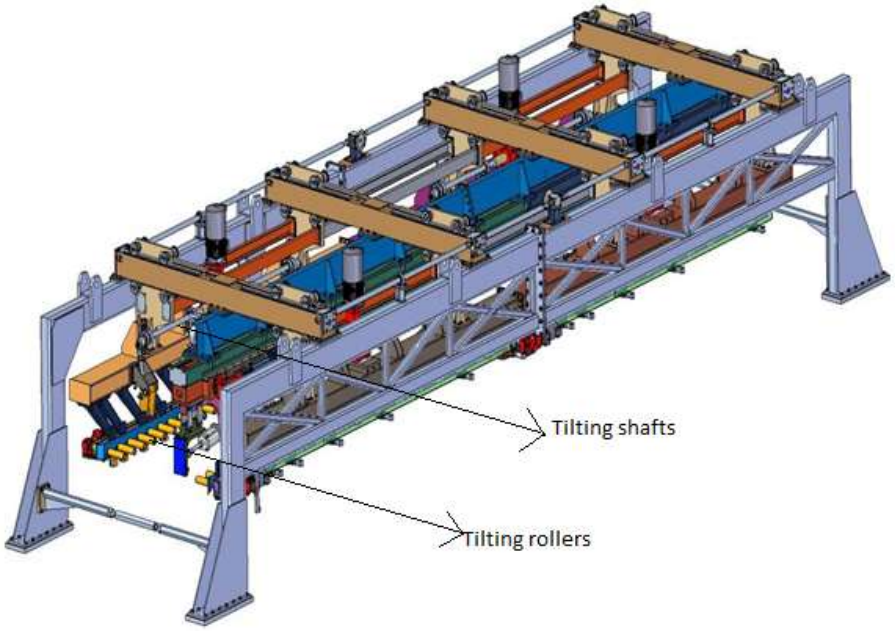


Figure 3: STACKER EQUIPMENT

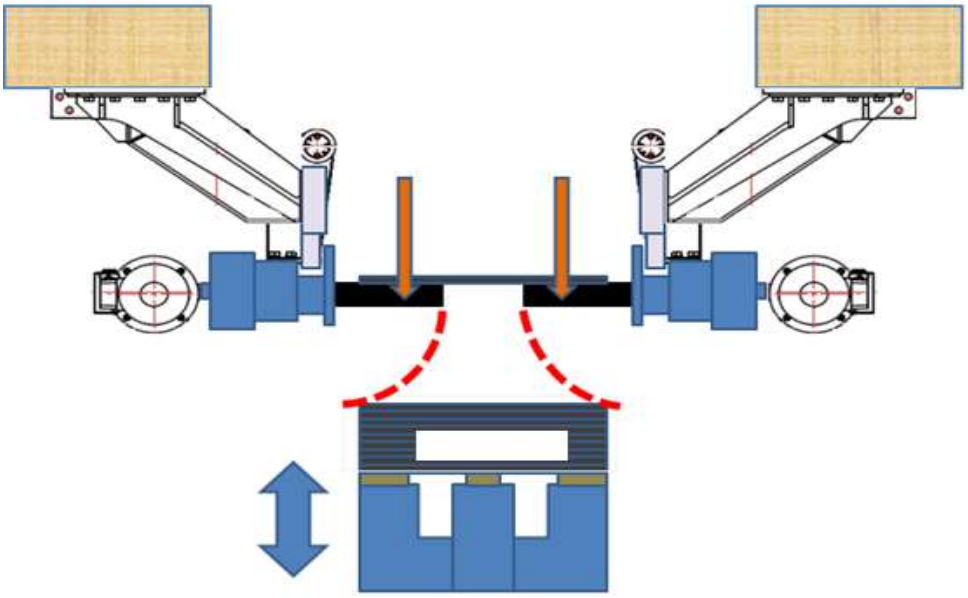


Figure 4: STACKER CLEARANCE BETWEEN TILTING ROLLER AND PLATES BEFORE MODIFICATION

The above figure shows the stacker equipment earlier where the sheets fall on the table and while tilting the roller will touch the edge of the sheets as indicated with red mark (dotted line) so the rollers will get bend and if excess load is acted the tilting shafts also get sheared because there is no proper clearance between the roller and plate.

VII CAUSE ENUMERATION TYPE FISHBONE DIAGRAM

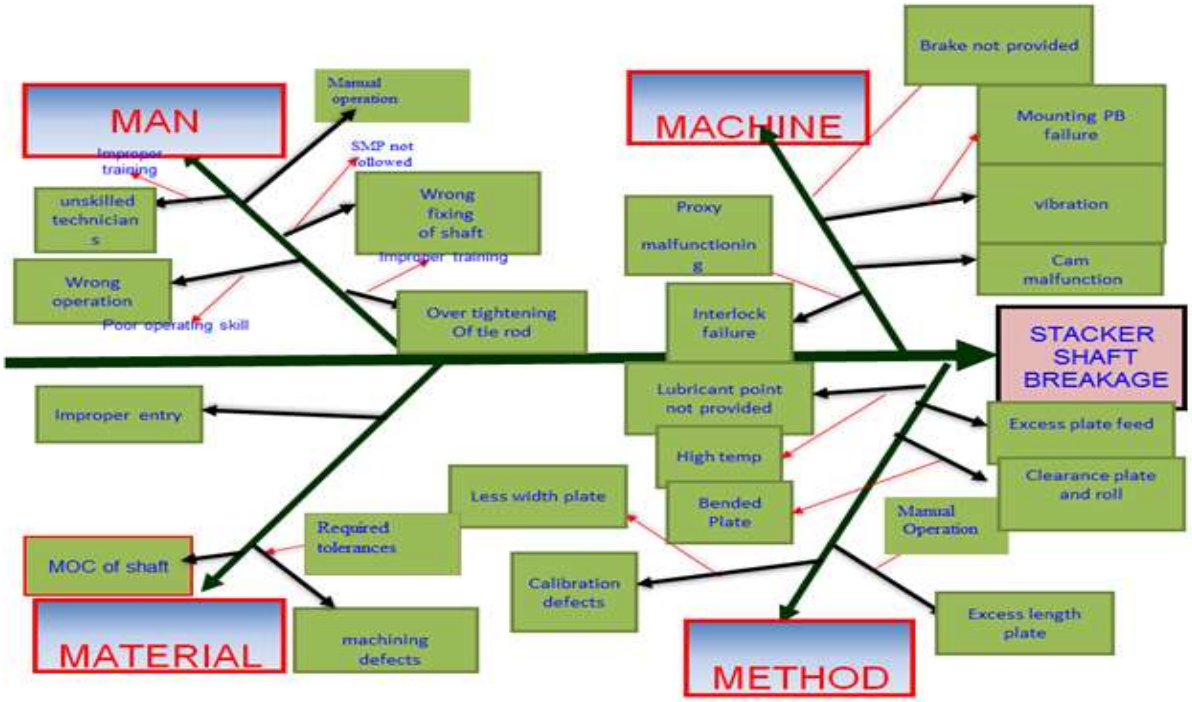


Figure 5: Fish Bone Diagram

Identified probable causes were distributed into man, machine, method and material in Ishikawa diagram to find actual root cause. (Cause enumeration type)

Those identified causes are man & method and machine & material were 5& 3 respectively.

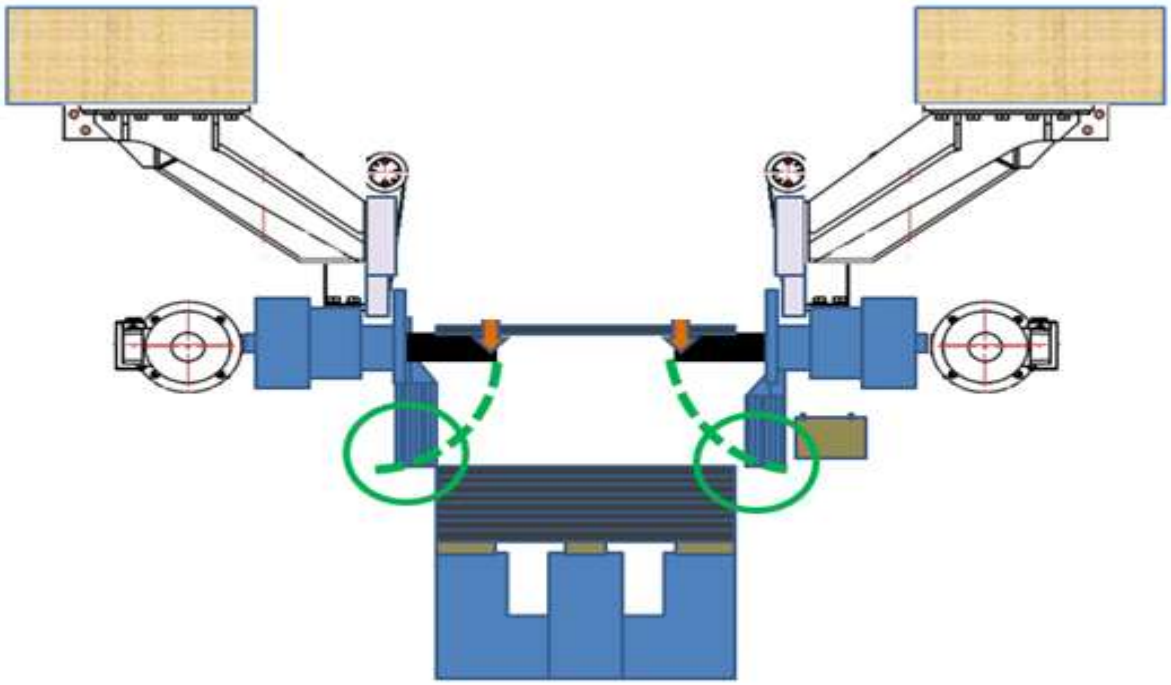
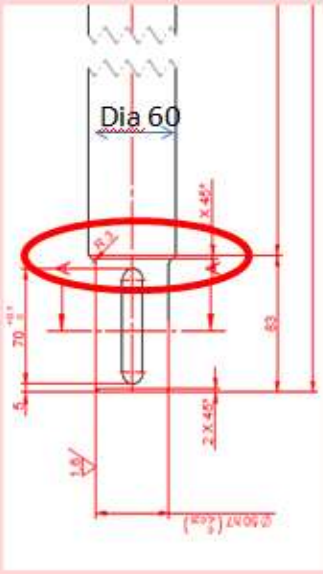
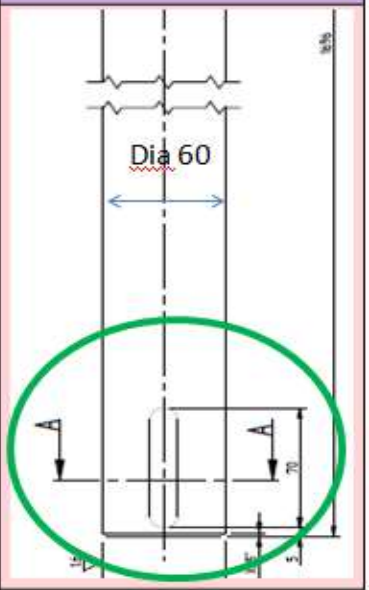


Figure 6: Stacker modification between tilting roller and plates

The above figure shows the modification of tilting rollers where the length of the rollers is reduced from length 325mm to 275mm the length of shaft reduced to 50mm and while tilting the clearance of 10-15mm will be obtained and the damage of tilting roller and shaft are reduced.

Table 2: Modification of shaft

Sl No	Observation after Correction 1	STANDARD	Modification in dimension
1	 Here, we planed to do increase the step dia of the shaft OD & Cam ID by 10mm in CRS.		

As shown in above table when the tilting rollers are bended the tilting shaft gets bended and sometimes will shear so it is observed that the shaft was always sheared at the step area so after brain storming the step diameter is changed from 50mm to 60mm where the shaft shearing has been avoided.

SHAFT SHEAR AFTER MODIFICATION

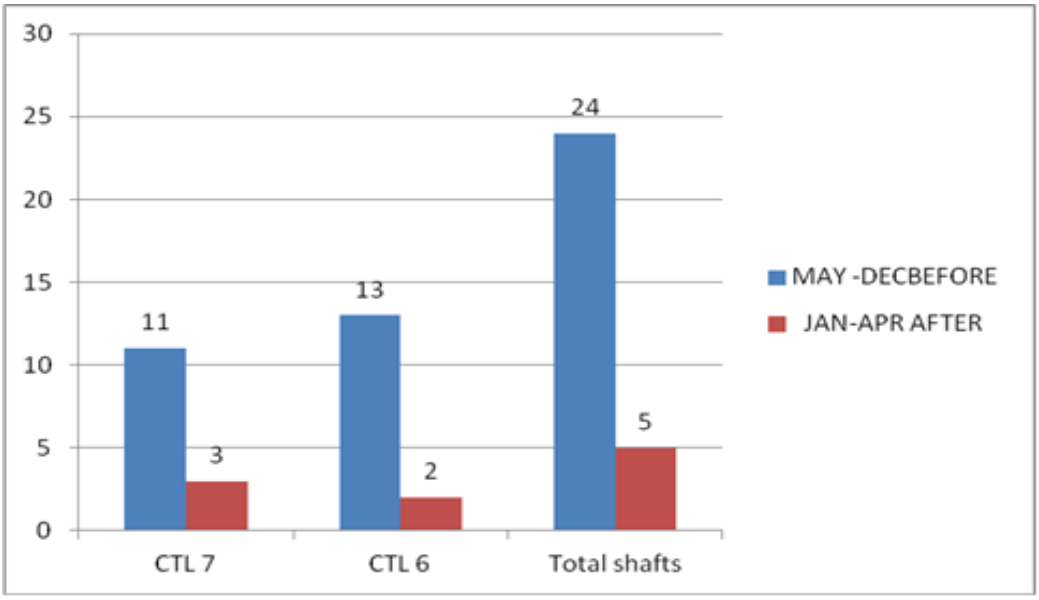


Figure 7: Shaft shear after modification analysis

VIII RESULTS AND DISCUSSIONS

Modification of stacker tilting rollers and tilting shaft reduces the delay time in achieving higher production rates.
Necessity of taking out the bended sheets are reduced due to less number sheets bend after modification and total operation time of machine is improved.
Positioning of the belt exactly in center is reduced so manpower availability for other works is improved. At regular intervals checking of tie rod length and lock nuts is reduced do more clearance between sheets and tilting rollers.
Better quality of sheets is achieved and reduced the lesser scarp generation Number of shafts sheared is reduced for 5 numbers earlier were 24 numbers shafts s h e a r e d before project. Average time required to carry out to change the tilting shaft is 2hrs thus 2hrs of CTL idle time is reduced which can utilized for production Increased production of average of 120tons per shaft to change the shaft time.

IX CONCLUSION

Duration of tilting roller and shaft change activity in stacker involved more number of manpower and defects in sheets which lead to more time to carry out to change and to remove the bended sheets. Modification of stacker tilting shaft and tilting rollers reduced the number of breakdown of stacker and also decreased the bending of sheets which results in achieving120tons of production more than earlier for every tilting shaft breakdown and improved the quality of sheets.
The problem of sheet struck in between tilting roller makes the sheet bended and folded edges which are having sharp corners may cause the harm to people working to remove the sheets struck in between rollers this was reduced and the modification resulted in less breakdowns and less delay and safe environment to people working.

X FUTURE SCOPE

Stacker can be further modified with respect to Plummer blocks the Plummer blocks are getting damaged once in 4months so the material of present Plummer block is cast iron so material of the Plummer can be changed with mild steel of outer body to reduce the damage to Plummer block and stacker performance can be improved.

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